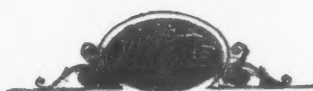


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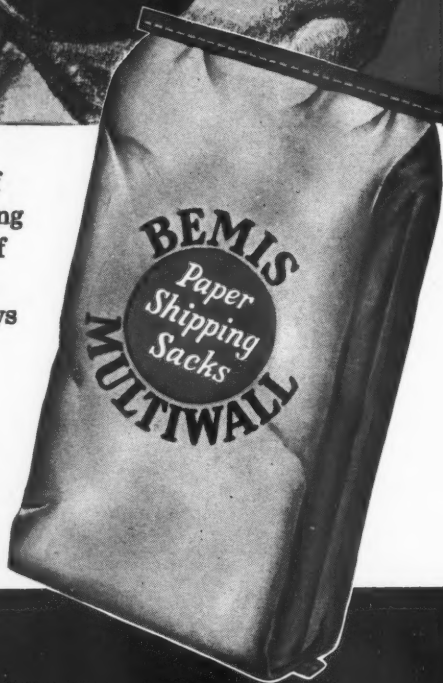
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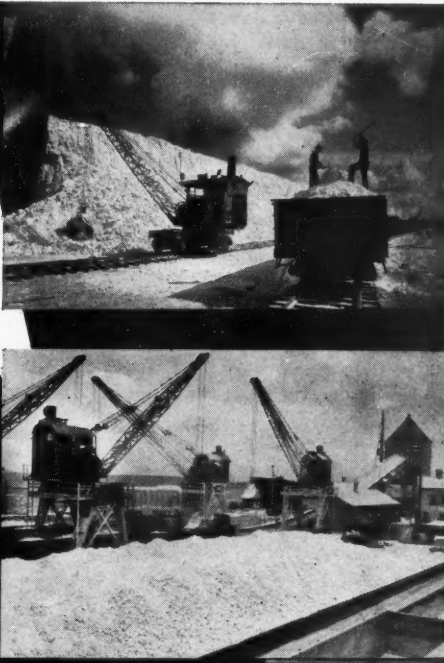
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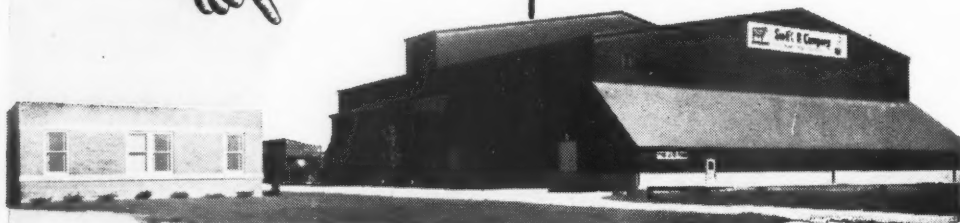
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# The American FERTILIZER

Vol. 110

JANUARY 22, 1949

No. 2

## Nitrogation, Nitrojection, and Soil Fumigation

### Their Application and their Results\*

By F. H. LEAVITT

*Technologist, Agricultural Department, Shell Chemical Corporation, San Francisco, California*

When speaking before a group, many of whom are unknown to me, I have found it well to begin by defining terms I may use which may be unfamiliar to that group. This morning I shall use but two such terms, "nitrogation" and "nitrojection."

The first, nitrogation, as you might guess, was coined by an advertising man and means simply the act of nitrogen fertilization through the absorption of anhydrous ammonia by water and its distribution by irrigation. The second, nitrojection, means simply the act of nitrogen fertilization by direct injection of anhydrous ammonia into soil without the use of irrigation water. Both processes have been conceived and developed by our organization over a period of the past fourteen years.

We in California may or may not be fortunate in being located in a state where soils have been developed under arid conditions and irrigation is almost a necessity. Arid soils, as a general rule, are nitrogen-deficient, and our soils certainly are no exception. Under arid conditions, the development of new processes such as these we describe has presented problems, the solution of which could not be approached in the light of past experience. In bringing you this brief record of our solution to these problems,

it is our hope that our experience may be of benefit to the industry. Please recall that as I quote figures from time to time they are of necessity only approximate and are necessarily on the high side.

As I have said, nitrogation and nitrojection utilize anhydrous ammonia as their source of nitrogen. Anhydrous ammonia, as you no doubt know, contains 82.5 per cent nitrogen. It is a gas under conditions of normal temperature and pressure. However, by compression and cooling, it can be converted to a liquid, in which condition it may be carried in pressure vessels from the place of manufacture to the point of use.

We are using vessels of many sizes in our agricultural fields. They range in size from the tank car of 50,000-pound capacity, safety-valve protected at 225 pounds pressure, down to cylinders of 150-pound capacity, tested to withstand pressure to 800 pounds per square inch. We have found it advisable and possible to develop our business into a year-round operation, thus obviating the necessity of installing large-capacity storage units, such as hortonspheres, which would add greatly to the expense of our operation. We have found the tank car to be a most useful container, not only for transportation but for cheap, short-time storage. The number of tank cars necessary for successful operation in any area, of course, would depend upon the volume of ammonia being used in that

\* From an address at the Fall Meeting, The National Fertilizer Association, Atlanta, Ga., November 15-17, 1948.

area and the distance over which the anhydrous ammonia would be transported. It is safe to estimate that the most rapid turn-around time for any area would be not less than one trip in two weeks.

Up to the present time, we have been using the 150-pound cylinder for normal field operations. These cylinders are filled from the 50,000-pound tank car at bottling plants strategically located throughout the areas we serve. In our operations, we have found it necessary to utilize in the neighborhood of 15,000 of these cylinders. The investment is not a small one, inasmuch as each cylinder now represents a capital outlay of approximately fifty dollars. In order that the small cylinders can be made to pay off, we find it necessary that their turn-around time also be maintained at at least two trips per month. During the peak seasons, we are able to turn them four times a month and, on rare occasions, five times a month.

Transportation of the 150-pound cylinders from the point of filling to the field depots is accomplished by large trucks, capable of handling 126 filled cylinders or 150 empty cylinders. These trucks operate from our filling depots, which are spaced, as we have mentioned, strategically in order that these large transport trucks be not required to travel more than 150 miles in either direction from those filling points. Equipment of this size represents an investment of between \$18,000 and \$20,000 for each unit. At least two bulk trucks are required for each distribution point, and in some areas as many as six are required.

From the small depots, small pick-up trucks, capable of handling from 20 to 25 full cylinders, pick up their loads and distribute them to the individual farms where the material is to be used. Some of our larger agencies operate as many as 14 of these ton-and-a-half trucks.

Up to this point, the mechanics of the use of either nitrojection or nitrojection ammonia are identical, but from this point on we will deal entirely with nitrojection. The cylinders, upon arrival at the field to be fertilized, are unloaded from the truck and placed in a horizontal position on the ground. They are then manifolded together in groups of two or three, or a single cylinder may be used if desired.

When the assembly, with a meter, is complete, the cylinder valves are opened by permitting the ammonia to flow from the cylinder through the manifold tubing up to the main control valve below the orifice. After

the cylinder valves are opened, the flow may then be started or stopped by use of the main control valve.

The pressure of the ammonia in the cylinder is quite easily determined by merely measuring the temperature of the flowing ammonia prior to its expansion on passing through the orifice, for the ammonia pressure is in direct proportion to the temperature—the higher the temperature, the higher the pressure.

Knowing the pressure of the gas in the cylinder, and knowing the desired amount of ammonia to be delivered per hour, the service man need merely refer to a prepared table to determine the proper size orifice to use in the orifice union. The service men become so adept at the metering of ammonia that it is seldom necessary for them to refer to charts under normal conditions. Anhydrous ammonia is used on a wide variety of crops throughout the irrigated sections of California.

A large variety of crops is being fertilized by nitrojection. These include beans, artichokes, flax, barley, walnuts, onions, pumpkins, melons, sugar beets, berries, carrots and other root crops, hops, citrus fruit, peaches, apricots. It is also used extensively by the big growers of flower seeds in California.

#### Nitrojection

With the beginning of nitrojection, equipment was necessary for the application of the material. The first piece of nitrojection equipment developed, of necessity, made use of existing cultivation equipment insofar as was possible. We used a Killifer cultivator, upon which was mounted a single cylinder of ammonia. A rather crude drag was prepared to seal cultivator shank channels following the injection of the ammonia.

After some preliminary work with trailer-type tools, a small John Deere rubber-tired tractor was utilized as an injection tool. A small tractor was employed, largely because it could be loaded in the field and moved readily from spot to spot where experimental work was being conducted. The small John Deere had sufficient power to handle two injection shanks.

An experimental work demonstrated the efficiency of nitrojection, larger equipment was developed. This Farmall H, carrying four cylinders, is now being used regularly for nitrojection on sugar beets, tomatoes, lettuce, and numerous other row crops. The four cylinders carry sufficient ammonia for standard application on six acres. This equipment will normally cover from 25 to 40 acres per day, dependent upon row spacing.

(Continued on page 24)

## Problems in Fertilizer Application\*

**F**ERTILIZER materials used annually by farmers in the United States now approximate 16 million tons which are applied on some 250 million acres of land. They range from compressed gases to liquids and dry granular products. They are applied on a wide range of crops grown on an equally wide range of soils and under varied climatic conditions.

Increasing use of these commercial fertilizers has emphasized their proper placement for maximum returns and quality products. They may produce results definitely harmful with lowering of yields, neither harmful nor beneficial, or highly beneficial with big increases in crop returns, depending in part on where and how they are placed with respect to the seed, seedpiece, or transplant, composition of the fertilizer, climatic conditions, soil, and similar factors.

Farmers who use fertilizers do so, of course, with the expectation that the returns will more than pay the cost of fertilizer and additional expense of its application, thereby yielding a larger profit on their investment in land, equipment, and labor required in producing a crop. The increasing total use of fertilizers as well as their spreading use into areas where in years before the war farmers used only small quantities is indicative of the favorable returns farmers have been getting where fertilizers are rightly used.

Fertilizer placement studies are being carried on at experiment stations throughout the country and each year the volume of data available increases. Each year also, however, the magnitude of the fertilizer placement problem increases and new developments in agricultural science and technology as well as changing farming practices emphasize needs for new work.

In the stimulation and initiation of such experiments as well as in the evaluation of results, the National Joint Committee on Fertilizer Application acts as a clearing house. At the annual meeting of this committee in Cincinnati, Ohio, on September 8, held as a joint session with the American

Society for Horticultural Science, Dr. A. L. Schrader of the Maryland Experiment Station pointed out that a total of 912 fertilizer placement experiments were conducted under sponsorship of this committee on horticultural crops alone beginning with 1929 when the committee was organized and including 1946. The total of placement experiments on all crops for this period was 2,174, which with the results of field observations are the basis for the placement recommendations for a wide range of crops throughout the country. It was indicated at the annual meeting that revised and broadened recommendations of the committee to include additional crops are now being compiled and will soon be ready for publication.

Reviewing the background of the fertilizer placement studies and the work of the national committee, Dr. Schrader said: "Earlier work stressed the practical need for information on the immediate effects of various methods of fertilizer placement, but these studies soon uncovered the need for fundamental work to explain the results of fertilizer placement or to iron out contradictions. In a larger sense the committee has become interested in any type of mineral nutrition, soil studies, or machine design that may afford the answers to questions of placement, time of use, minerals, balance, and other practical aspects. In recent years considerable stress has been laid on balanced nutrition. Now attention is being given to research on radioactive isotopes. Also the question of deeper placement of fertilizers has been emphasized. In general, the work of the committee is directed toward freedom and ease of communication among scientists and the promotion of cooperative efforts among scientists and agencies in scientific advancement, but within the limited objective of efficient fertilizer use."

The joint meeting at Cincinnati was devoted largely to discussions of new problems in fertilizer placement and evaluation of experimental results. "Evaluations must be critical, must show trends and progress, and show lines to follow in the future," Dr. W. P. Judkins of the Ohio Experiment Station told the conference in discussing fertilizer prac-

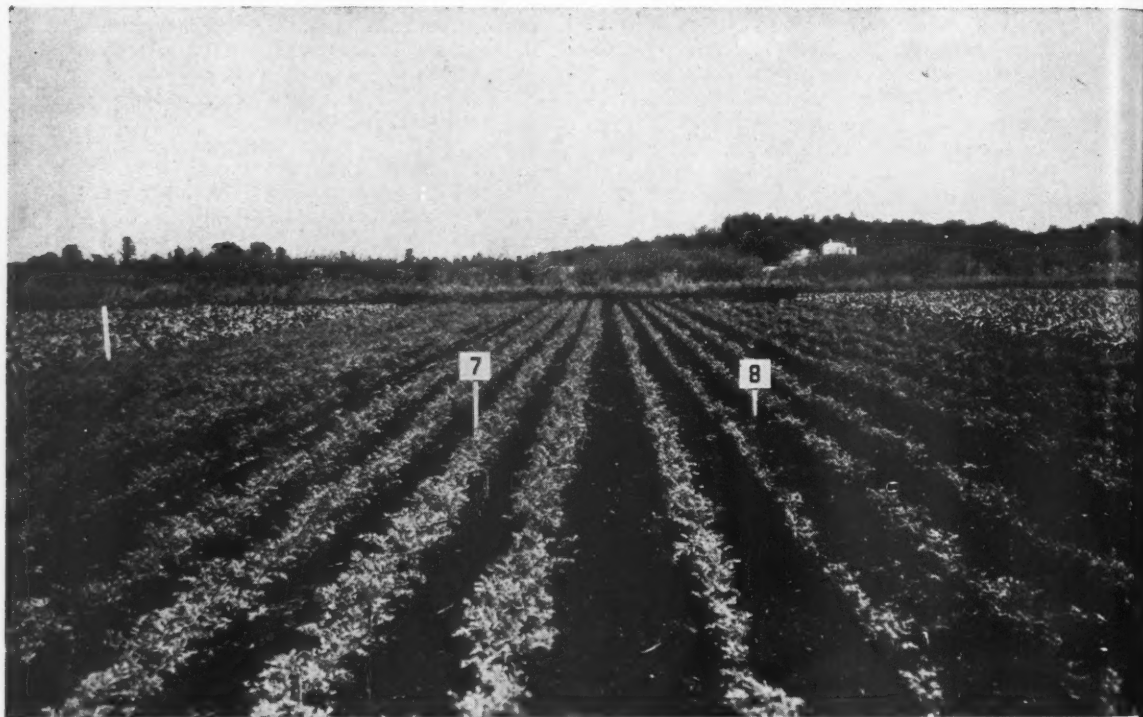
\* Reprinted from National County Agent and Vo-Ag Teacher, December, 1948.

tices on tree and small fruit crops. "Empirical information has been given a great deal of emphasis in the formulation of fertilizer practices, particularly with these crops," he said. "Investigators must continue observations in the field and check these with laboratory experiments."

The research worker is a servant of the producer and the consuming public, Dr. Judkins pointed out, and must direct his work so as to answer problems that growers face,

apples, results in poorer color, and the solids content is not so good. With strawberries nitrogen applied in the early spring sometimes produces soft berries that do not ship well. Research workers do not now have adequate information concerning the effects of fertilization on quality, and more work is needed, Dr. Judkins emphasized.

Another of these problems involves nutrient element balance, which is now receiving increasing attention. Some recent work has



Effects of fertilizer placement on carrots in Michigan, 1947. Band 7—Fertilizer placed one inch to side and two inches below seed. Band 8—Fertilizer placed one inch under seed. Rate: 800 pounds of 0-10-30 per acre.

keeping in mind the interrelations of soil, climate, moisture, insect and disease control, and similar factors that may affect returns and which are important in the evaluation of fertilizer practices.

#### Information Needed

As examples of information needed by growers Dr. Judkins mentioned new problems of fertilization now arising. One, for example, involves the present emphasis on high quality fruit. What is the effect of fertilizers on quality? Some experiments have shown that too much nitrogen delays the harvest of

shown a relationship between nitrogen fertilization and nutritional deficiencies. Some investigators have said that such deficiencies may result from an overbalancing of some of the other elements. In other instances, where there is only a modest supply of magnesium in the soil, deficiency symptoms may show up after applications of potassium. Growers need to know where this toxicity is likely to show up and they need the information well before the symptoms appear.

"Economically, with the proper utilization of good sound farming practices and

(Continued on page 26)

## N. F. A. to Meet in White Sulphur Springs, June 13-15

The 1949 Annual Meeting of the National Fertilizer Association will be held at the Greenbrier, White Sulphur Springs, West Virginia, on Monday, Tuesday and Wednesday, June 13th, 14th and 15th. Announcement of program details will be made later. For many years, the Greenbrier has been host to the N. F. A. at their spring convention, interrupted only by the war years when the hotel was taken over by the Government, first to house temporarily the diplomatic representatives of enemy countries pending their return to their native lands, and later as a war hospital.

## Smith Agricultural Chemical Expanding Saginaw Plant

At the annual meeting of the Smith Agricultural Chemical Co., held on January 10th, Frank R. Schwartz, Jr., was elected to the Board of Directors, thus increasing the number of directors to ten. The other nine directors were re-elected. Mr. Schwartz, who is a grandson of the late Marshall A. Smith, is assistant production manager of the company. A graduate of Williams College in chemistry and during the war served as an officer in the Navy in the Pacific area.

The annual balance sheet for the year ending October 31, 1948, showed an increase in sales of about 15 per cent. Due to rising costs in materials, labor and freight rates, net profits declined from \$356,148 to \$317,141, or \$6.50 per share of common stock outstanding after allowance for dividends on the preferred stock and for federal income tax.

In his report to the stockholder, President J. E. Powell announced the addition being made to the company's plant at Saginaw, Michigan. A new building of steel and corrugated asbestos Transite, 268 feet by 133 feet is being built to house a complete acidulating unit with grinding equipment, a 40-ton Sturtevant den, rock silos and acid storage tanks. Modern mixing equipment is also being installed, which will increase the output of mixed fertilizers at this plant by at least 50 per cent. The new addition will be in operation by late spring or early summer.

During the past year the company added to their line a new product, "Wedo," a lawn fertilizer containing a weed killer (2, 4-D).

## TVA to Increase Fertilizer Output

The annual budget message of President Truman, submitted to Congress on January 10th, includes an item for the Tennessee Valley Authority for the production of 102,420 tons of phosphate fertilizers during the 1950 fiscal year. This compares with an output of 96,332 tons during the 1948 fiscal year and of 90,866 tons in the present (1949) fiscal year.

The agency said that the 1950 estimate contemplates full-scale operation of a new experimental calcium metaphosphate unit scheduled for completion in 1949. About one-fourth of the 21,600 tons of  $P_2O_5$  to be produced in this unit is scheduled for use in test demonstrations; the remainder will be offered for sale in limited areas where the use of the product has been adequately demonstrated through farm test-demonstration programs.

It was also stated that the experimental chemical production facilities at Wilson Dam, Alabama, and Columbia, Tennessee also will be operated during 1950 for the production of concentrated phosphate and nitrogen fertilizers. These products will be made available for test-demonstration purposes and for sale under agreements that will assure that the materials will be used in a manner that will aid the improved farming practices to conserve the soil, increase its fertility, and control water.

Facilities for the production of ammonia and ammonia nitrate fertilizer were operated at capacity in 1948 and are scheduled for full operation in 1949 and 1950 it was added.

The budget recommended appropriations of \$1,134,000 for fertilizer and munitions research for 1950, the same as for this year.

## Phillips Ammonium Sulphate Plant in Operation

The new sulphate of ammonia plant being erected by the Phillips Chemical Company, a subsidiary of Phillips Petroleum Company, began operation on January 9th. Only a part of its ultimate capacity is now available, but construction is expected to be completed and the plant in full operation by the end of February. The construction and installation is being handled by Chemical Construction Corporation and any annual production of more than 250,000 tons of sulphate of ammonia is expected. The Army has contracted to take the entire output until June 30, 1949.

## THE AMERICAN FERTILIZER

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PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

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## Indiana Tobacco Champions Use Plenty of Fertilizer

Although tobacco in Indiana is grown to any great extent in only a few southern counties, O. H. McNary, agricultural agent of Switzerland County, felt that his tobacco farmers were not getting the attention and credit due them. Accordingly, in 1941 he organized a tobacco club, with an annual contest based on gross sales returns. The winning fields ranged from a gross of \$1,260 per acre in 1944 to a low of \$817 in 1945. The 1947 contest was won by Frank Bittle with a gross income of \$987 per acre. The 1948 winner will not be determined until that year's crop is sold early in 1949.

In reporting this contest, *Prairie Farmer* describes the soil program used by Mr. Bittle as well as by John Vanosdol, a three-time winner in previous years. Winners of the contest have followed definite fertility programs. Bittle, for instance, uses the same plot of ground each year for his tobacco crop. Maintaining fertility is a problem, but by proper management his soil has improved each year.

Following each tobacco harvest, Bittle seeds rye and vetch. The seeding gets an application of 800 pounds per acre of 20 per cent superphosphate. During the winter, stable manure from 20 head of cattle is spread over the four acres.

In the spring, just before plowing, Bittle spreads 100 pounds of ammonium nitrate per acre. If the vetch fails to catch he uses 200 pounds of the nitrate. While preparing the seedbed he works 1,500 pounds per acre of 4-12-8 fertilizer into the soil.

By following this practice each year, Bittle finds his production keeps going up and the soil gets better. He has few weeds to contend with because they have no chance to go to seed. Compared to the soil he started with 16 years ago, production is now tops. When he started, his production was only 679 pounds a year.

Vanosdol, the three-time winner, uses the same plot each year, too. Fertility is maintained and improved by following each tobacco crop with wheat. In the following spring the wheat is treated with 300 pounds per acre of ammonium nitrate. Before plowing down the wheat, he spreads 1,000 pounds of 4-12-8 fertilizer per acre plus 16 loads of good stable manure on each acre of tobacco land. Then while working the ground for transplanting, another 200 pounds of ammonium nitrate is worked into the soil.

When Vanosdol sets the plants he adds 300 to 400 pounds of 4-12-8 in the row to act as a starter. He advises cutting down on the nitrogen because it produces too many of the coarse, heavy red leaves which knock down the quality. The heavy nitrogen works fine when the market wants quantity and is not too particular about quality.

### International Sales Increase

Net sales of International Minerals & Chemical Corporation for the six months ending December 31, 1948, representing the first half of its fiscal year, were \$20,146,566 as compared with \$19,090,107 for the corresponding period of the previous year. The increase amounted to six per cent.

Net earnings for the same six month period ending December 31, 1948 were \$1,646,192 as compared with \$1,230,008 for the previous corresponding period, or an increase of 34 per cent. It was pointed out that the earnings for the first six months reflect the usual seasonal trend in the industry.

### X-rays Pick Out Soil Minerals

A new piece of apparatus, which identifies minerals in soils within a matter of minutes by means of X-rays, has recently been purchased by the Soils Department of the Connecticut Agricultural Experiment Station. According to Dr. C. L. W. Swanson and Dr. Gerard A. Bourbeau, who will work with the instrument, it will speed up enormously the task of finding what kind of minerals and how much of each are contained in a particular soil.

Heretofore, identification of soil minerals has been a laborious process. Consequently, little work has been done on finding out the kinds and amounts of minerals in soils. Information on soil minerals will make it possible to work out practical solutions to soil problems.

Called a Geiger counter X-ray spectrometer, the machine sends X-rays through samples of soil placed in it. Each mineral diffracts X-rays in an entirely different pattern from any other mineral. By means of a recorder attachment, these differing patterns become immediately apparent. The wavy lines by which they are pictured are actually drawn on paper by the recorder as the instrument operates. The instrument also contains a Geiger tube and counter which can measure

the pulsations or strength of the diffracted rays for more exact information.

The Connecticut Station Soils Department is the second in the country to make use of the spectrometer for soils research. The Connecticut soils men anticipate that the machine will be put to immediate use for analyzing samples collected in the soil survey of the State, now in progress. They point out that, besides identifying and measuring quantities of minerals, it will be used in determining the structure of minerals that are of interest in soil fertility.

### Australia and New Zealand Buy Christmas Island Phosphate Deposits

The Australian and New Zealand governments have agreed to acquire, at a cost of 2,750,000 pounds, the rights of the Christmas Islands Phosphate Company, Ltd., to deposits of phosphate rock on the island, which is south of Java in the Indian Ocean.

The island is reported to contain the largest known resources of high-grade phosphate rock in the Pacific, excepting Nauru and Ocean Islands. The deposits are estimated at about 30,000,000 long tons.

A phosphate rock grinding plant, with a capacity of 30,000 long tons annually will be erected at Whangarei, New Zealand.

### Davison Sales and Earnings Report

Sales of the Davison Chemical Corporation for the last six months of 1948 totaled \$14,376,000, compared with \$14,335,000 for the same period of 1947. Net earnings, after provision for income taxes, amounted to \$617,000 compared with \$1,104,000 for the same period last year, and \$262,000 for July-December, 1946.

Chester F. Hockley, Board Chairman and President of the Corporation, in commenting on the results for the period, stated that, in addition to inability to reflect increased cost in selling prices, earnings were further adversely affected by the longshoremen's strike in November and the shortage of available ships since the end of the strike necessitated postponement of a substantial volume of shipments which would otherwise have been made in November and December. He pointed out however, that earnings for the present fiscal year to date exceed those for any similar period in the Corporation's history, except the 1947 period.

## Fertilizer and Cultivation Effects on Soil Structure

By DR. DANIEL G. ALDRICH, JR.\*

**A** BREAKDOWN in soil structure, as a rule, results in a reduced rate of water penetration into the soil. This breakdown can be attributed to faulty fertilizer applications, cultivation methods, or excessive traffic. Reduced water penetration means reduced water distribution, reduced fertilizer distribution and reduced aeration, leading to decreasing yields of citrus.

Soil structure is the manner in which soil particles, sand, silt or clay are bound together as granules. Thus, the structure of a soil may change from time to time with variations in the nature of the material which binds the particles together. Texture on the other hand is a more or less permanent property of the soil in that it refers only to the proportionate amount of sand, silt, or clay particles present in a soil and not to the manner in which these particles may be bound together.

Calcium, and magnesium to a lesser degree, tend to promote and maintain good structure. Thus, good structure normally will be found in soils which contain considerable quantities of calcium. Calcium may be supplied by naturally occurring calcium sulfate (gypsum), or calcium carbonate (limestone), or calcium silicate in the soil, or may be added in fertilizers, or by the irrigation water.

Sodium and ammonia on the other hand act in the direction of breaking down soil structure. Soils saturated with these nutrients slake or run together when wet, thereby limiting water movement and aeration. If a grove is located on a loam or clay soil which is low in naturally occurring calcium and is irrigated with water of low calcium content,

repeated heavy applications of a sodium-containing fertilizer may eventually produce a soil of sufficiently high sodium content to produce structural breakdown.

It is only under very special conditions that ammonia builds up in the soil to a degree capable of destroying soil structure. Under normal soil conditions, ammonia added to or produced in the soil is converted to nitrates which are taken up by plants or leached from the soil. However, ammonia added as ammonium sulfate may build up to a point capable of impairing structure if the *pH* of the soil is reduced to the point where soil organisms capable of converting ammonia to nitrates are destroyed. Such may be the case when repeated heavy applications of ammonium sulfate are applied to a soil which has no naturally occurring limestone or other basic materials to neutralize the residual acidity of this fertilizer.

Organic matter acts to create and preserve soil structure. The application of manure or other bulky organic materials to the soil and the growing of cover crops may be expected to reduce structural deterioration induced by high concentrations of sodium or ammonia in the soil. Where organic materials are used exclusively as the source of applied fertilizer, soil structure should be relatively good.

At the University of California Citrus Experiment Station, the idea that soil structure may be impaired by excessive cultivation was tested by Dr. E. R. Parker and Dr. Hans Jenny\*\* by subjecting the soil of a dry-farmed field to intensive traffic by a track-type tractor and by discing. The soil was worked by these two devices at two moisture contents, one at about the wilting point (dry soil), and the other at about field capacity

\* University of California Citrus Experiment Station, Riverside, Cal. Reprinted from "American Cyanograms."

\*\* Parker, E. R., and Jenny, H. 1946 Cultivation effect on irrigation. Citrus Leaves 24:6-7, 36-37.

(Continued on page 22)

# FERTILIZER MATERIALS

FAST DEPENDABLE BROKERAGE SERVICE

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## FERTILIZER MATERIALS MARKET

### NEW YORK

**Slow Movement of Mixed Fertilizers to Farms Taxes Storage Space at Plants and Slows Production. Price Increases Reported in Chemical Nitrogen Materials but Demand Still Far Ahead of Supply. Organics Prices Firm. French Potash Imports Eases Potash Situation**

*Exclusive Correspondence to "The American Fertilizer"*

NEW YORK, January 19, 1948.

Fertilizer manufacturers report a slow movement of mixed goods to the farm which seems to be behind shipments at this time last year. As a result, some plants have a considerable amount of raw materials and mixed fertilizer on hand and in some cases have been forced to hold up further shipments of incoming raw materials until they can secure necessary storage space.

#### **Sulphate of Ammonia**

One producer raised the price of this material from \$45.00 per ton to \$48 per ton, f.o.b. production point and some reports indicated that other producers might follow suit in the near future. Demand was heavy from various sections.

#### **Nitrate of Soda**

Several cargoes arrived at Atlantic ports and are being shipped out to the trade. Domestic producers have not changed the price so far but the imported material was raised the first of the year to \$54.50 per ton in bags ex-vessel Atlantic ports.

#### **Ammonium Nitrate**

Some further price increases reported with one producer curtailing production due to power difficulties.

#### **Nitrogen Solutions**

While some increase in shipments has been noted in certain sections, some manufacturers are still very short of supplies, with little relief looked for over the near future.

#### **Organics**

The organic markets maintained a firm undertone and prices all along the line were steady to advancing. Tankage sold at \$9.00 per unit of ammonia (\$10.94 per unit N) f.o.b. eastern points, to both feed and fertilizer interests. Blood was scarce with last

sales made at \$9.50 (\$11.55 per unit N) f.o.b. Soybean meal was moving in good volume mostly to feed trade and offerings of linseed meal for quick shipment were hard to locate. There was some demand for cottonseed meal from both feed and fertilizer people.

#### **Castor Pomace**

This material was available for quick shipment and demand is rather poor. As soon as the heavy shipping season in the South opens up, it is thought this situation will correct itself.

#### **Fish Meal**

The price advanced slightly due to renewed buying by feed trade, with last sales for ground menhaden fish meal at \$152.00 per ton. Some fish scrap sold at \$142.50 per ton, f.o.b. Atlantic coast points. No foreign material was reported on the market.

#### **Bone Meal**

This material continues scarce and hard to obtain for nearby shipment. Some producers are sold ahead for the next 60 days with the large part of the production going to the feed trade who are still anxious to buy.

#### **Superphosphate**

This material is in good supply but triple superphosphate is still short in certain sections. Some export inquiries are in the market but no large amount of business was reported. Producers are shipping against old contracts.

#### **Potash**

With the arrival of several cargoes of French potash from abroad at Atlantic coast ports, this material was in a slightly easier position although most buyers could use additional supplies if available. It is thought domestic production will be higher this year than last, providing producers are not faced with any breakdowns.

**PHILADELPHIA**

**Chemical Nitrogen Still Scarce, with Some Price Increases Reported. Potash Supplies Expected to Improve**

*Exclusive Correspondence to "The American Fertilizer"*

PHILADELPHIA, January 17, 1949.

Demand is quite active for chemical nitrogen which is still scarce. It is expected that the demand for complete fertilizers will continue strong for several years, though it is feared prices must advance.

*Sulphate of Ammonia.*—The production generally is heavily sold on contract, with demand still far ahead of supply. One producer is reported to have just advanced his price three dollars per ton.

*Nitrate of Soda.*—Demand continues far ahead of the available supply, and the Chilean price has been advanced three dollars per ton.

*Ammonium Nitrate.*—Production price was advanced January 1 but the supply is insufficient to meet requirements.

*Castor Pomace.*—Limited offerings are now being made for prompt and nearby shipment at \$24.00 per ton, f.o.b. production works.

*Blood, Tankage Bone.*—The demand for these organics is rather limited and there is no urgency to sell. Blood is quoted in New York at \$9.50 to \$10.00 per unit of ammonia (\$11.55 to \$12.15 per unit N), and at \$9.25 (\$11.24 per unit N) in the West. Tankage is priced at \$9.00 (\$10.94 per unit N), New York with \$9.25 (\$11.24 per unit N) in the West. Bone meal is greatly in demand with no current offerings obtainable. Sales of hoof meal were reported at \$7.00 per unit of ammonia (\$8.51 per unit N) in the West.

*Fish Scrap.*—Trading has been quiet and almost entirely with feed mixers. Sixty per cent menhaden meal is quoted at \$142.50, with scrap rather nominal at \$132.50 per ton.

*Phosphate Rock.*—Production continues in ample supply to meet all demands, and the situation is more or less normal.

*Superphosphate.*—Market is quiet but firm, and increased mixer demand is expected shortly.

*Potash.*—Production is expected to increase materially in a month or two, but meanwhile shipments are keeping up with contract schedules. However, demand much exceeds the supply and no stock accumulations are possible. French potash arrivals are expected shortly at Baltimore, Norfolk and Savannah.

**CHARLESTON**

**Better Fertilizer Movement to Farms Reported. Feed Market Taking Organics at Higher Prices. French Potash Imports on Way**

*Exclusive Correspondence to "The American Fertilizer"*

CHARLESTON, January 19, 1949.

The movement of fertilizers to the farms has begun to increase but heavy volume has not been reached. Potash and nitrogen continue short of demand but superphosphate supplies are adequate.

*Organics.*—The fertilizer trade shows very little interest in organics but the feed market continues strong enough to keep such organics as tankage and blood beyond the reach of fertilizer manufacturers. Due to high prices, imported organics continue to draw practically no interest.

*Castor Pomace.*—Sales for spring shipment are reported at \$24.00 per ton in bags, f.o.b. northeastern production points.

*Dried Gound Blood.*—Offerings are very few and the market is tight at around \$10.00 per unit of ammonia (\$12.15 per unit N) in bulk, f.o.b. New York, and at Chicago around \$9.75 per unit of ammonia (\$11.85 per unit N).

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## Trona Muriate of Potash

Potash, one of the important ingredients of mixed fertilizer, is a vital soil nutrient which aids crop production and helps resist plant diseases. To provide the maximum of this important plant food, we are operating full capacity at Trona, 24 hours a day.

## Three Elephant Borax

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**Potash.**—Demand continues active, with production keeping pace with the schedule of commitments. Supply, however, is still inadequate to meet all calls. It is reported that approximately 4,500 tons of French potash will arrive at Norfolk and Savannah during the last half of January. Another cargo is expected to arrive at Baltimore at approximately the same time. Contract price for this imported material is 95 cents per unit of  $K_2O$  in bulk, c.i.f. Atlantic ports.

**Phosphate Rock.**—The market continues steady with supply and demand practically in balance.

**Superphosphate.**—Prices continue firm with stocks adequate to meet requirements.

**Sulphate of Ammonia.**—The market continues tight with demand in excess of supply and no expected easement for the balance of the fertilizer season. No change in producers' prices has been reported.

**Ammonium Nitrate.**—Effective January 1, domestic ammonium nitrate prices range from \$58.00 to \$59.00 per ton in paper bags, untagged. Demand continues far in excess of supply.

**Nitrate of Soda.**—As of December 31, 1948 the price of Chilean nitrate of soda was advanced to \$51.00 per ton in bulk and \$54.50

per ton in 100 pound paper bags, carload lots, f.o.b. cars at the ports. No change in the price of domestic nitrate of soda has been reported.

## CHICAGO

### Demand for Feed Materials Continues but Some Declines in Prices Reported

*Exclusive Correspondence to "The American Fertilizer"*

CHICAGO, January 19, 1949.

There is a continued demand for feeding materials but a tendency on the part of manufacturers to cut prices somewhat at various points. We have heard of some meat scraps selling as low as \$108.00 per ton. Others claim they are getting \$115.00 but this price possibly applies to exceptionally favorable rate points.

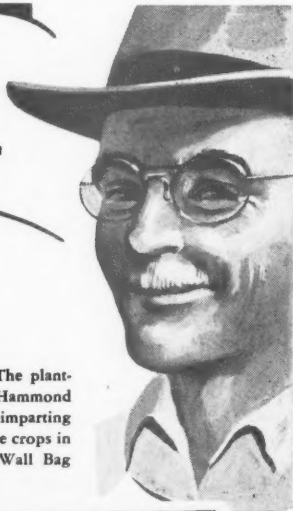
Digester tankage is still holding up. Local sales are being made on a basis of \$115.00 to \$128.00. Outside material has sold at \$125.00. Dry rendered tankage has advanced somewhat, last trading at \$2.00 to \$2.05 per unit of protein, delivered, making the f.o.b. price \$1.90 to \$1.95. Dried blood is also strong with sales reported at \$10.00 per unit of ammonia (\$12.15 per unit N) and the available supply is very limited. Wet rendered tankage is moving on the basis of

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\$9.50 to \$9.70 (\$11.55 to \$11.79 per unit N) delivered, according to quality.

A little steamed bone meal and raw bone meal is moving occasionally at unchanged prices of \$65.00 to \$70.00 per ton.

### November Superphosphate Production

Production of superphosphate during November at 181 plants in the United States amounted to 854,000 equivalent short tons (basis 18% A.P.A.), according to reports submitted to The National Fertilizer Association and a summary of reports submitted to the Bureau of the Census. This is the third consecutive month in which production has been below that of a year ago—the November production being three per cent off from the 881,000 tons reported for the same month in 1947. Production during October was down seven per cent and during September it was down two per cent. The total supply for November, however, amounting to 2,199,000 tons, was 25 per cent greater than for a year ago; shipments during the month, totaling 483,000 tons, were fractionally above last November, while the amount of superphosphate used in mixed goods was up seven per cent. Stocks at the end of the month, amounting to 1,358,000 tons, were 43 per cent above those reported for November 30, 1947.

During November production of normal superphosphate amounted to 750,000 tons (18% A.P.A.), representing 88 per cent of the total, and was down six per cent from the 801,000 tons recorded for the previous November. Production of wet base goods, which has ranged from 2,400 tons to 7,600 tons this year, totaled 5,400 tons (18% A.P.A.). Such production was a little below a year ago, but was up five per cent from the 5,206 tons indicated for October.

The November tonnage reported for pro-

duction of concentrated superphosphate, 39,500 tons (45% A.P.A.), was up sharply from the 29,900 tons produced a year ago—the increase amounting to 32 per cent. Compared with the record high of 44,900 tons indicated for September and the slightly lower figure for October, however, the tonnage reported for November was down about 12 per cent. Converted to an 18 per cent basis, production of concentrated superphosphate represented 12 per cent of the total compared with 13 per cent for October and 14 per cent for September.

Despite the fact that monthly production this year has been below that of the same month in 1947 on four separate occasions, total equivalent production for the January-November period, amounting to 9,731,000 short tons (18% A.P.A.), was four per cent above the 9,341,000 tons reported for the same period in 1947. For the 11 months, production of normal superphosphate totaled 8,593,000 tons, or 88 per cent of all production.

Shipments of superphosphate for January-November, which amounted to 5,511,000 tons were six per cent greater than the 5,192,000 tons recorded for the same period in 1947. The tonnage used in mixed goods, 4,051,000 tons, was about three per cent lower.

	Normal 18% A.P.A. Tons	Concen- trated 45% A.P.A. Tons	Base Goods 18% A.P.A. Tons
Production			
November, 1948...	749,719	39,505	5,433
October, 1948....	713,395	44,892	5,192
November, 1947..	782,329	27,892	5,603
Shipments and Used in Producing Plants			
November, 1948..	729,002	43,038	3,546
October, 1948....	780,149	39,321	4,519
November, 1947..	715,678	31,485	3,333
Stocks on Hand			
Nov. 30, 1948....	1,157,125	75,443	12,667
Oct. 31, 1948.....	1,125,217	78,976	10,778
Nov. 30, 1947....	762,060	61,640	17,495

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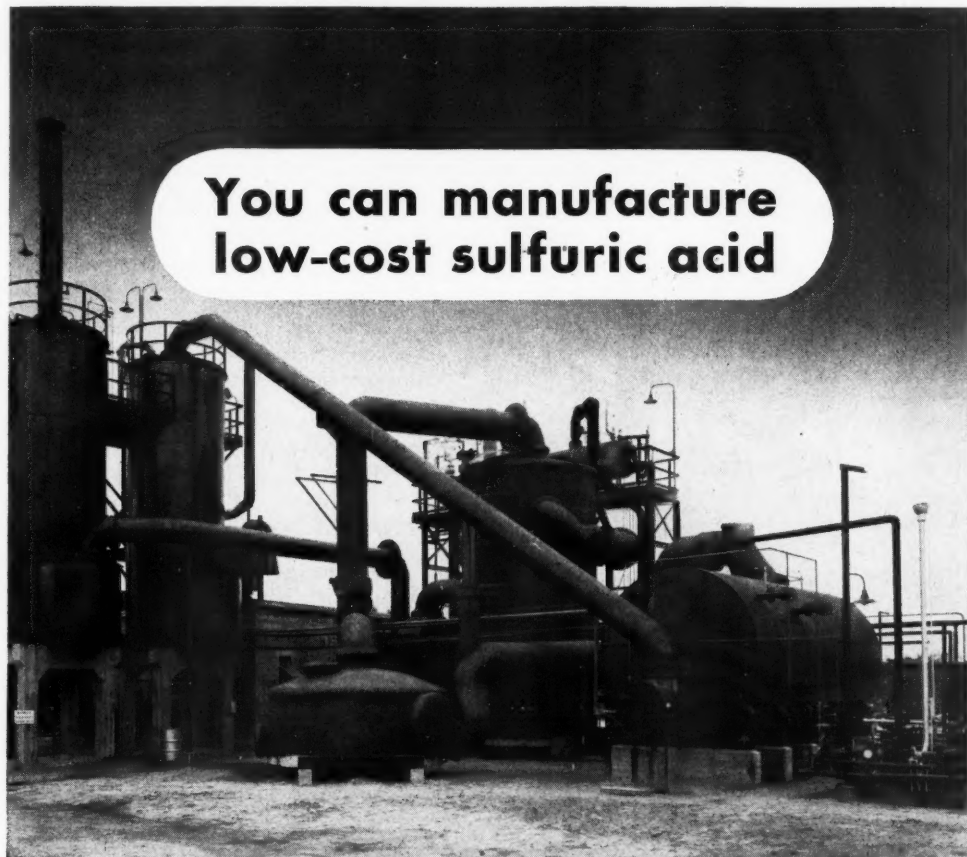
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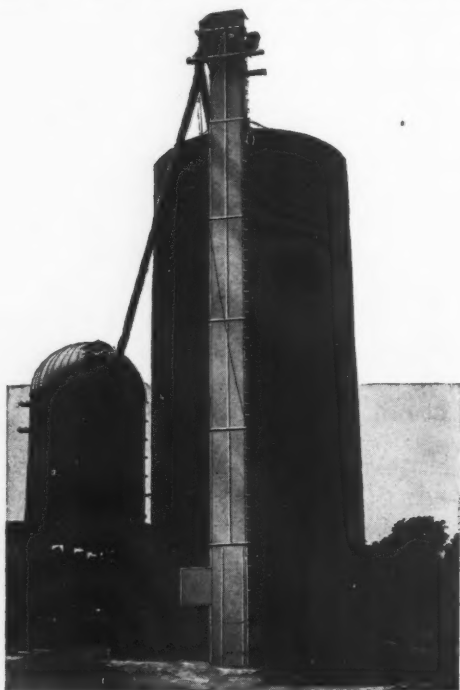
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### St. Regis Promotes Hill

Arch Carswell, executive vice president of St. Regis Sales Corporation, subsidiary of St. Regis Paper Company, announces the appointment of Logan G. Hill as eastern sales manager of the Multiwall Bag Division of the company. He was formerly assistant eastern sales manager.

Mr. Hill is a graduate of Yale University and has been associated with sales promotion and multiwall bag sales of St. Regis since 1930, both in New York and Chicago.

### Chain Belt Company Opens Two Sales Offices

Chain Belt Company, of Milwaukee, Wis., has opened two new district sales offices, in St. Louis, Mo. and Jacksonville, Fla.

The St. Louis office is located at 8001 Clayton Road and will be in charge of Clarence R. Studer, District Sales Engineer. Mr. Studer, a graduate of Washington State College, has handled the products of Chain Belt Company in the St. Louis area for four years prior to his recent appointment as District Sales Engineer. Earlier experience includes 19 years in the power transmission field.

The Jacksonville office, at 340 W. Church St., will be under the direction of David B. Hill. A graduate of Clemson College, Mr. Hill joined Chain Belt in 1937 and was District Sales Engineer at its Chicago and Atlanta offices.

### FERTILIZER AND CULTIVATION EFFECTS ON SOIL STRUCTURE

(Continued from page 14)

(wet soil). The tractor produced structural breakdown in both the wilt and dry soils. Discing also produced structural breakdown in the dry and wet soil, but the effect was not as quickly apparent in the latter. By eliminating all cultivation on these mechanically worked plots, in conjunction with the growing of annual cover crops, the above ground portions of which were removed, Parker and Jenny found marked structural improvement during a period of 8 years. Thus when structural breakdown has been induced by faulty cultivation practices, as evidenced by plowsole development, a reduction in cultivation and grove traffic will help considerably in remedying this condition.

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Our New Orleans factory is prepared to execute your orders for any type multiwall bag—pasted or sewn bottom, open mouth or valve.

Our nearest plant or sales office will be pleased to quote on your requirements for 1949.



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NEW YORK**

### Bemis Holds West Coast Multiwall School

Sales representatives of the eight western plants and sales offices of Bemis Bro. Bag Company attended a multiwall paper shipping sack school during the week of January 10 at the company's Wilmington, California, multiwall plant. The five-day course included complete coverage of the multiwall manufacturing processes, multiwall performance, new developments and markets, and company multiwall sales.

G. A. Bauman, manager of the Wilmington plant, and his staff conducted the school, assisted by C. W. Akin, supervisor of multiwall sales at the Bemis general offices in St. Louis.

Similar schools are planned for future dates in eastern territories, at which time representatives of the company's eastern and mid-western plants will attend.

### NITROGATION, NITROJECTION, AND SOIL FUMIGATION

(Continued from page 8)

The early work with nitrojection tools, particularly of the trailer type, demonstrated to us that standard cultivation equipment could not be used. We were forced, therefore, to develop equipment especially designed for nitrojection. One of the earlier models built in our own shops is unique in that the main frame of the tool remains stationary and only the tool bar moves up and down as required. With standard cultivation equipment, the tool bar is attached rigidly to the frame, the entire frame rising as the tools are drawn from the ground. While the early nitrojection equipment was comparatively small, ranging in width from six to eight feet, the more recent equipment is on a somewhat larger scale.

An equipment which carries four cylinders and a 13-foot tool bar, represents an investment of close to \$1,000. Another nitrojection tool measured 39 feet in width and handled 21 cylinders at a time. The coverage ranged up to 180 acres per day. This equipment, of course, is designed for operation on the larger fields of grain and cotton.

In the early stages of the development of nitrojection, a standard 4/8-inch John Deere spear-point shank was utilized as an injection tool. More recently, however, we have developed our own injection shanks, which are self-sealing.

Rarely is it necessary for us to use any sort of drag or shank channel closure apparatus, even though we are injecting ammonia vapor into soil at the rate of slightly more than two cubic feet per linear foot of travel.

The most recent development in the field of nitrojection is the bulk handling of ammonia. An 800-pound tank, mounted on an independent trailer, attached behind a 16-foot Killifer cultivator equipped for nitrojection.

Still later, use was made of a 4500-pound-capacity tank mounted on a four-wheel trailer. Either tank worked satisfactorily. The larger unit supplied ammonia for almost an entire day. However, it could not be used except on fine textured soils of clay or clay loam. With the sandier soils, the increased weight of the large tank increased the power demands to a point beyond practicability.

Nitrojection is being used with success on sugar beets, cotton, rice, grain, as well as other crops.

### Soil Fumigation

With the development of chemicals capable of killing underground pests, such as nematodes, it was a natural step from nitrojection to soil fumigation. Nitrojection equipment can be converted for soil fumigation with a minimum of effort.

By working with hand injection equipment on small test plots, the proper amounts of fumigant and spacing of application can be determined. Large scale demonstrations on sugar beets, tobacco, orchards, and grape culture have shown that the various nematodes can be eliminated satisfactorily by this new method.

Agriculture becomes more and more complex as the years move along. No longer can we be satisfied as fertilizer manufacturers or retailers to sell fertilizers solely. We must look to the condition of soil, not only physically and chemically, but we must also look to its condition biotically.

## Stedman FERTILIZER PLANT EQUIPMENT

Dependable for Fifty Years

All-Steel	Pan Mixers—	Vibrating
Self-Contained	Wet Mixing	Screens
Fertilizer	Swing Hammer	Dust Weigh
Mixing Units	and Cage Type	Hoppers
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STEDMAN'S FOUNDRY & MACHINE WORKS  
AURORA, INDIANA, U. S. A.      Founded 1884

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**are the perfect conditioner for  
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- ✓ Scientifically dried and ground especially for fertilizer conditioning.
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### PROBLEMS IN FERTILIZER APPLICATION

(Continued from page 10)

efficient applications of lime and fertilizer materials, the intermixing of agronomic and vegetable crops is desirable," J. B. Hester, soil technologist with the agricultural research department of the Campbell Soup Company, told the conference in discussing evaluation of fertilizer practices on vegetable crops. He illustrated his talk with slides showing effects of fertilization and farming practices on such crops as tomatoes, lima beans, peas, and corn. "Fertilization practices, must be hinged around the production of the main cash crop, and the full utilization of the plant food in the soil realized through the production of crops that are able to utilize the surplus."

Mr. Hester emphasized particularly the importance of favorable nutrition and soil environmental conditions in efficient crop production. The production of phenomenal crop yields is not just a coincidence, but is a result of favorable climatical conditions and soil environmental and nutritional factors, he pointed out. Climatic conditions influence the nutrition and the soil conditions almost as profoundly as they influence the growth and appearance of the crop, he said.

#### Aerial Application

The application of nutrients to the above-ground parts of plants to correct deficiencies is another new development coming in for attention by the fertilizer placement committee and associate agronomic, crops, and agricultural engineering investigators. Heretofore, the roots of plants have always been considered as the organs of nutrition and the soil as the source of plant nutrients. With increasing knowledge of the part micro-elements play in plant nutrition, however, this situation is changing. Some recent research

in this field was reviewed by Dr. D. I. Arnon of the California Experiment Station. Scientists were the first to use applications to the aerial parts of plants in order to establish the essential value of certain elements, he said. Later it was found that field practice dictated such methods from the standpoint of cost and ease as well as effects. He cited a number of examples.

In one case in California where peach trees had made excellent growth and yielded up to 14 tons an acre the trees began to show zinc deficiency symptoms during their fifth year. In the seventh year many of them were dying. An analysis showed that the trees including roots, leaves, and fruits removed only one ounce of zinc per acre annually and at the time of the deficiency there were 3,000 pounds of zinc per acre in the root zone. Evidently, however, this zinc was not available to the trees. In another case 1,500 pounds of zinc sulphite per acre gave no cure, but two and one-half ounces of the same compound injected into the trunks of large apple trees cured the deficiency and kept the trees healthy for four years.

Such facts have already amply demonstrated the desirability of aerial applications for some of the micro-elements and methods now being used are: (1) Injections of dry salts through holes bored into the trunks of the trees; (2) driving pieces of metal, such as zinc or galvanized iron, into the trunks; (3) foliage sprays for applications of copper, manganese, iron, and boron on a wide variety of crops; (4) dormant sprays, as with zinc on most deciduous fruit trees but not on cherry or walnut; and (5) daubing of pruning wounds for certain grape varieties. Dr. Arnon also mentioned work by some investigators in applying potassium sulfate as a spray as well as urea as a foliage nitrogen spray.

"In surveying attempts of supplying nutrients through the aerial parts of plants," Dr.

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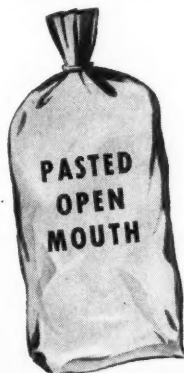
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Arnon said, "one is struck by our lack of information about fundamental aspects of this subject. Why, for example, do different species differ so markedly in their response to foliage sprays? What is the extent of translocation of a nutrient applied in this manner? What do scientists mean by chlorosis, and what precisely occurs when chlorosis is cured? These are only examples of some of the problems begging for answers. They are not academic questions. Some of them may be in the field of pure science, but in agriculture there are many examples where academic or pure science research of one day has become practical farm practices only a short time later."

#### Equipment Developments

New developments in fertilizer application equipment and equipment currently being manufactured were reviewed by R. M. Merrill of Deere and Company. "The great increase in the use of fertilizers during the war years and since has stimulated activity in the production of application equipment," he said, "Efforts are constantly being made to improve distributing mechanisms as to accuracy of control and uniformity of application to the soil. Attempts to discover materials or material coatings to withstand the corrosive effects of fertilizers are continuing."

Questions listed by Mr. Merrill on which manufacturers of fertilizer equipment need more information were:

1. To what extent will plow down, or pre-planting, fertilizer practices replace the application at planting time?
2. How does plow sole application and chisel cultivator application compare with broadcast-on-surface-before plowing application?
3. Does the advantage of placing fertilizer in bands on each side of the row justify the more complex and more costly equipment necessary for making this placement?

#### Radioactive Isotopes

Indicative of subjects demanding attention of fertilizer investigators throughout the country also were the discussions of the role of radioactive isotopes and other new techniques in evaluating fertilizer practices pre-

sented by Dr. L. W. Dean of the USDA Bureau of Plant Industry, Soils, and Agricultural Engineering; the soilless culture method of supplying the nutrient requirements of plants, by Dr. O. W. Davidson of the New Jersey Experiment Station; and the role of legume and nonlegume cover crops, and sod and hay crops, and their fertilization in rotations to improve soil structure and fertility, a discussion panel with Kirk Fox, of *Successful Farming*, acting as moderator.

Fertilizer research workers consider radioactive isotopes as the best tool they have ever had in the evaluation of fertilizer placement techniques. Dr. Dean showed by means of a motion picture the methods used in manufacturing radioactive superphosphate and calcium metaphosphate at the Agricultural Research Center, Beltsville, Md., for use in field experiments which have been undertaken for the first time this last year in a number of states. Data on these experiments have not yet been analyzed, and several years of work may be necessary before enough information will be available to permit conclusions to be drawn.

It was reported by Dr. Davidson that experiments in New Jersey with the soilless culture method of supplying nutrients have indicated close correlations between nutrient absorption and light. Using absorption data developed in the gravel culture beds and applying nutrients in two-week periods the investigators have been able to get better nutrition of the plants. With this method, the absorption of nitrogen has been almost 100 per cent.

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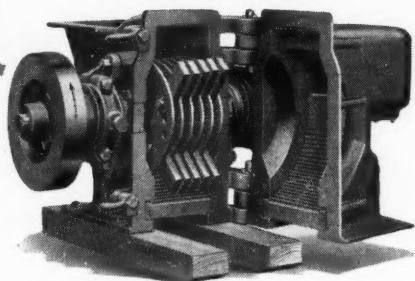
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